MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. L. DECEMBER 13, 1889. No. 2

W. H. M. CHRISTIE, M.A., F.R.S., President, in the Chair.

Alfred Fowler, Demonstrator of Astronomical Physics, Normal School of Science, South Kensington, S.W.;

Joseph Kleiber, Privat-Docent of the University of St. Petersburg;

David Smart, L.R.C.P., M.R.C.S., L.S.A., 108 Grange Road, Bermondsey, S.E.,

were balloted for and duly elected Fellows of the Society.

The following Candidates were proposed as Fellows of the Society, the name of the proposer from personal knowledge being appended:—

James Blair Forgan, 15 Pall Mall, S.W. (proposed by C. Piazzi Smyth);

Richard A. Gregory, Assistant Solar Physics Committee, South Kensington, 115 Rylston Road, Fulham, S.W. (proposed by J. Norman Lockyer);

A. N. Harris, hotel keeper, 21 Lambhay Street, Plymouth (proposed by the Rev. J. M. Bacon);

Frederick William Henkel, jun., merchant, 32 Berwick Road, Walthamstow (proposed by J. D. McClure).

On some of the Features of the Arrangement of Stars in Space.
By Edward S. Holden, LL.D., Foreign Associate.

Under ordinary circumstances, observers with equatorial telescopes use eyepieces which have fields hardly larger than 10 or 15 minutes of arc. As a consequence of this, features of the sky which have great extension are utterly lost to them. Long streams of stars (and these are often one, two, or more degrees in length), large nebulæ (such as those of *Orion* and *Andromeda*), and objects of a similar nature are not well seen, and their true relations to the surrounding stars are not discovered. If the telescope is used in sweeps, as was done by Sir William Herschel,

some of the disadvantages of small fields are done away with by the method of observation itself. I had striking proof of this in my experience with the 15½-inch equatorial of the Washburn Observatory, which was used in this manner. If the observations with small fields, or those made in sweeps, are charted, then some of the larger features of the sky will be reproduced on paper, and can be discovered and studied at leisure.

This method was employed with fruitful results by the late Mr. Proctor.

It may almost be said that only those astronomers who are in the habit of using large fields (and therefore low powers) obtain a vivid idea of the aspect of the larger features of the heavens. Such a vivid conception can always be attained under these circumstances; but when attained it is almost impossible to convey an accurate notion of it to others without constructing a careful chart of what is seen. This, of course, is usually impossible. I may illustrate my meaning by supposing an observer to be viewing the Milky Way with an eyepiece having a field of 8′ or 10′. The whole field will be filled with stars apparently scattered at random. Neither the stars nor the unoccupied spaces of the background will suggest any order.

Occasionally a double star will pass through the field of view, and the mind at once seizes on this; for here is a definiteness and order which gives a sense of relief from the chaos of stars among which it chances to fall. Small nebulæ have the same effect. We have certain definite notions about them also. If the eyepiece is changed to one which gives twice or thrice the field of view, and if the observer has acquired the skill to see with this power nearly all that is shown with the higher power, then the sense of order which the mind instinctively seeks for can often be found in the arrangement of the stars themselves. Half a dozen stars in a row pass by with only a moment's attention in the smaller field, but when we see the first six stars succeeded by a stream of six, ten, or twenty more, the attention becomes rivetted on this feature, and there is a positive sense of pleasure in tracing such a stream to its end. Some fields and regions are characterised by streams like this. Others are rich in small definite ellipses of stars, often all of the same size. In some cases stars are surrounded by circles of other fainter stars. In other instances the ellipses become tolerably regular ovals, often of large size. These interlace in the most intricate manner. After having discovered such ovals as these we can frequently trace new and highly interesting features of the kind by paying attention to stars of one magnitude only. If we regard the 11th magnitude stars alone, for example, we may find rings and ovals of these stars forming a regular pattern in the sky. Interlacing with these may be found another pattern of similar ovals (usually smaller) of stars of the 12th magnitude, and so on.

In certain parts of the sky the arrangement is so intricate

that no single pattern can be discovered. In most regions a little attention will show that there are several patterns, one for each of the fainter magnitudes of stars. I have spoken of these patterns and arrangements at some length in the *Century Magazine* for September 1888, and have suggested some consequences which may follow from a study of them. The idea of them was derived from actual observations of the heavens with the equatorial of the Washburn Observatory in 1884 and 1885. It is extremely difficult to convey notions of this sort to a reader, or to anyone who has not the field of stars actually before him in the telescope. At one time I endeavoured to surmount this difficulty by tracing from some of Peters' Ecliptic Charts successively the stars of the 10th magnitude, then those of the 11th, then those of the 12th, and so on. Thus each one of Peters' charts gave me four or five different maps, each containing stars of one magnitude only. Each one of these maps was studied separately, to find out the arrangement or pattern of the stars of that particular magnitude at that particular place; and a comparison of the patterns from two maps threw some light on the question as to whether the stars of the two magnitudes in question were or were not connected in space. Immense pains were necessary in tracing the separate maps, and even after they were made they were not easy to compare.

We have now in photography a means of making these researches in a more satisfactory manner. A series of charts of a given region can be made by giving successive exposures of 30, 60, 90, 150, 180, &c., minutes, with the same lens. It is possible to get excellent definition with a portrait lens over an area of 25 square degrees; and at least tolerable definition can be obtained over 100 square degrees. If the lens is of 6 or 8 inches aperture, stars of the 12th, 13th, or even 14th magnitude can be registered without going to excessively long exposures. In this way, then, we have immense advantages in exhibiting the larger features of the sky. It is only necessary to photograph them, to copy the original negative, and on this copy to mark such lines as will direct attention to the features in question. It will not do so well to simply reproduce the negative. There is an art in examining an astronomical photograph which is akin to the art of observing with an astronomical telescope, although it is easy to acquire, so that it is desirable to indicate the main features in the way I have suggested, and then to leave the eye to trace out the remainder of the figure or pattern. If too many lines are traced on the negative the eye becomes confused. The lines drawn on *negatives* should represent the areas of fewer stars. Lines drawn on *positives* should represent areas of many stars.

Mr. Barnard, of the Lick Observatory, has lately made some very interesting experiments with a portrait lens of nearly 6 inches aperture and 31 inches focus. Some of his photographs of the Milky Way are of extreme beauty. I have examined

these in the manner described, and some of them are reproduced in the accompanying photographs. It must be understood, of course, that these photographs are intended mainly as *diagrams*, to bring out the various patterns which are to be found in the arrangements of the star-groups. The successive copyings of the negative, and especially the interpolation of the guiding lines, have naturally injured the pictorial effect.

Lick Observatory:
1889 *September* 1.

The following photographs illustrating this paper are placed in the Library:—

1, 2. Milky Way, R.A. $18^h\ 44^m$, Decl. − 6° (Messier 11)
3, 4. Milky Way, R.A. $17^h\ 56^m$, Decl. − 28°.
5. Milky Way, R.A. $18^h\ 11^m$, Decl. − 20°.
6, 7. Nebula of Andromeda.

Note on the Spectrum of the Sun-spot of June 1889.

By the Rev. A. L. Cortie, S.J.

(*Communicated by E. W. Maunder.*)

In *Nature* of December 5, 1889, a list of bright lines is given which were observed by Professor Spörer, of Potsdam, on June 28, in a prominence that appeared as the large spot of that month was disappearing over the Sun's edge. The spectrum of this spot in the region D to B was observed at Stonyhurst on June 20, 22, 24, 26, and 27, the instrument used being the Browning automatic spectroscope, with a dispersion of twelve prisms of 60°. Of the seven lines measured by Professor Spörer in the same part of the spectrum of the prominence, excluding D_1, D_2, and C, four are due to calcium, the wave-lengths given being 672·6, 671·6, 649·2, and 646·2. Three other lines of calcium were observed between D and *b*, so that this element was very conspicuous in the prominence. In the spectrum of the spot all the lines given in Ångström's maps as due to calcium were seen to be widened; and of these the lines at 6492·41 and 6461·98, corresponding to Spörer's 649·2 and 646·2, were amongst the most widened lines in the spot, understanding by the term "most widened lines" those lines which were widened more than once their normal breadth. Four other calcium lines were also in this category, their wave-lengths being 6498·25, 6468·78, 6449·29, and 6438·35 respectively, and the widening of the rest was considerable, in no case being less than one-half the normal breadth of the line. Calcium was therefore also very conspicuous in the spectrum of the spot. On June 27 the line at 6492·41—one of the lines seen by Spörer the next day in the prominence—was widened no less than three times its normal breadth. On this day, when the spot was very near the edge of the Sun, several lines were seen to be displaced towards the violet end of the spectrum, among them being the iron lines, 6300·5, 6298·74, 6251·76, 6253·40, and particularly the calcium lines 6101·92 and 6121·34, although no displacement was noted in the calcium

lines seen bright in the prominence by Spörer the next day. It may be remembered that the line 6461·98 is common to the two elements calcium and iron. Besides the four calcium lines and the C line, Spörer also observed the D lines as bright in the prominence. In the spot the D lines were on the 20th nearly reversed, the lines being less dark where they crossed the spot; on the 22nd their widening was estimated as 0·2, while the C line was unaffected in the spot. On the 24th C was less dark over the spot, and D_1 and D_2 were widened 0·3. On the 26th D_1 and D_2 were less dark over the spot and displaced towards the more refrangible end of the spectrum. C was not observed. On the 27th D_1 and D_2 were widened 0·4 and displaced as before. As the spot was very near the Sun's limb, the field of view comprised not only the spot spectrum, but also the ordinary chromospheric lines. The bright line C was very much broadened at the solar limb. It could thence be traced as a bright band over the continuous spectrum right down to the penumbra of the spot. The band was on each side of the dark Fraunhofer line, and between 11 A.M. and noon was broader on the red than on the violet side of the line. The chromospheric line was also slightly displaced in the direction of the red. At 5.30 P.M., though the chromospheric line was not displaced, the bright band was broader on the violet than on the red side of the dark line. The dark line was itself unaffected in the spot, but was almost reversed on the following side of the spot, in all probability in the surrounding faculæ. In the following table are exhibited the results for all the calcium lines in this part of the spectrum:—

TABLE.

Calcium Lines in the Sun-spot of June 1889.

Wave-Length.	Coincident Element.	June 20.	June 22.	June 24.	June 26.	June 27.	Prominence (Spörer) June 28.	Remarks.
6726·5	...	...	...	0·5	...	...	bright	
17·16	...	...	...	0·5	...	...	bright	
6498·25	...	1·0	1·0	...	...	...	...	
92·41	...	1·0	1·0	1·5	1·5	3·0	bright	
68·78	...	0·6	...	...	...	...	...	
61·98	Fe	2·0	0·8	1·0	1·0	1·0	bright	
49·29	Ba	2·0	0·8	1·0	1·0	1·0	...	
38·35	Cd	2·0	0·8	1·0	1·0	1·0	...	
6168·48	...	0·8	...	...	...	...	...	
61·40	...	0·6	...	...	...	...	...	
21·34	Co	0·7	...	...	...	0·8	...	27th displaced to violet
01·92	Li	0·5	...	...	...	0·8	...	" "

Note.—Blanks in the above table do not mean that the line was not widened in the spot. The usual method of observation is first to note all the most widened lines between B and D, and then to observe every line in selected portions of the spectrum.

Spectra of Southern Stars observed at the Melbourne Observatory with the McClean Direct-vision Spectroscope attached to the South Equatorial. Observer, P. Baracchi.

II.

(*Communicated by R. L. J. Ellery, F.R.S., Government Astronomer.*)

No.	Star's Name	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
1	ϵ Phenicis	0 3 49	136 21	Yellowish star. Spectrum with very fine dark lines, difficult to see.
2	ι Ceti	0 13 49	99 26	Yellowish star. Spectrum with extremely faint dark lines.
3	π Toucani	0 15 35	160 14	Whitish star. Faint spectrum. Dark lines about F suspected.
4	β Hydri	0 19 51	167 52	Yellowish star. Spectrum with fine dark lines.
5	κ Phenicis	0 20 48	134 18	Whitish star. Spectrum with dark lines about F and G thick and conspicuous. Dark line about C suspected. Violet colour not seen.
6	α Phenicis	0 20 50	132 54	Yellowish star. Spectrum with very fine dark lines, difficult to see.
7	β Toucani	0 26 29	153 34	White ; double. Spectrum with dark lines about E, *b*, F, and G. G difficult. Violet hardly seen. E and *b* very faint. F thick and distinct.
8	Stone 194	0 27 43	153 38	White star. Spectrum with dark lines about F and G, thick and very distinct.
9	β Ceti	0 38 4	108 35	Spectrum with dark lines about C, E, *b*, F, G, and other very faint ones. Yellowish star.
10	β Phenicis	1 1 11	137 18	White star tending to yellow. Spectrum with dark lines about F and G, and others suspected. Violet not seen.
11	η Ceti	1 3 3	100 46	White star. Spectrum with dark lines at F and G well seen. G very broad and diffused. Dark lines about C, E, and *b* suspected. Blue colour preponderates.
12	ν Phenicis	1 10 13	136 7	Whitish star. Spectrum with a broad, nebulous, dark band about G. Dark lines suspected. F pretty well seen. No violet.
13	θ Ceti	1 18 31	98 45	Yellowish star. Spectrum with very faint dark lines suspected.

No.	Star's Name.	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
14	γ Phenicis	1 23 36	133 53	Spectrum with several dark lines. One very thick and black in the red; one in the orange also thick and well defined; a fainter one in the yellow; one about F tolerably conspicuous; several very fine and faint in the blue.
15	δ Phenicis	1 26 40	139 39	White star tending to yellow. Spectrum with fine dark lines suspected.
16	α Eridani	1 33 37	147 48	White star. Spectrum with dark lines about C, F, G, and one in the violet. C only visible at the edges of the spectrum; the others very distinct and prominent.
17	τ Ceti	1 38 59	106 31	Yellowish star. Spectrum with dark lines suspected.
18	χ Eridani	1 51 37	142 9	Continuous spectrum.
19	α Hydræ	1 55 17	152 6	Spectrum with dark lines about F and G.
20	υ^4 Eridani	4 13 44	124 4	White star. Spectrum with dark lines about E, F, and G. Other faint dark lines suspected.
21	υ^5 Eridani	4 19 54	124 16	Spectrum with dark lines about C, F, and G.
22	α Argus	6 21 31	142 38	Spectrum with dark lines; two of these are about F and G prominent and thick. Suspected bright band in the yellow (?) Blue and violet occupy together one-half, and the yellow and red together only one-fifth part of the whole length of the spectrum; the rest being taken by the green and greenish blue.
23	α Carinæ	9 8 4	148 31	Continuous spectrum. Green colour in large proportion. Violet not seen.
24	υ Argus	9 44 21	154 34	Spectrum with one dark line in the middle of the green. Other faint dark lines suspected.
25	ω Argus	10 11 7	159 29·5	Continuous spectrum.
26	θ^1 Crucis	11 57 26	152 42	Continuous spectrum. Blue and green preponderate. Violet not seen.
27	θ^2 Crucis	11 58 40	152 33	Continuous spectrum. ,, ,, ,,
28	ζ Crucis	12 12 29	153 23	Continuous spectrum. ,, ,, ,,
29	ι Crucis	12 39 10	150 23	Continuous spectrum. ,, ,, ,,
30	κ Crucis	12 47 15	149 47	Continuous spectrum. ,, ,, ,,

No.	Star's Name.	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
31	Stone 7112	12 48 8	146 35	Continuous spectrum. Blue and green preponderate. Violet not seen.
32	Stone 7113	12 48 9	146 34	Continuous spectrum. " " "
33	Stone 7119	12 49 29	146 14	Continuous spectrum. " " "
34	Stone 7208	13 0 37	149 16	Continuous spectrum. " " "
35	Stone 7238	13 5 26	149 20	Continuous spectrum. " " "
36	Stone 7244	13 6 3	149 14	Continuous spectrum. " " "
37	Stone 7253	13 7 27	148 31	Continuous spectrum. " " "
38	β Centauri	13 56 3	149 50	Yellowish star. Spectrum with dark lines. One extremely faint about C, only seen at the edges of the spectrum; one in the yellow about D as faint; one about G quite distinct and well defined, not thick; two far in the violet, uncertain; three extremely faint and diffused in the greenish blue. Yellow and green in large proportion.
39	ι Virginis	14 10 15	95 28	White star. Spectrum with dark lines suspected about C, F, and G. Bluish tint extending over green and yellow; violet hardly seen.
40	λ Virginis	14 13 9	102 52	Spectrum with dark lines about C, F, and G; F very thick and prominent; G faint and difficult; C only suspected. Bluish tint extending over a great portion of the spectrum; violet colour hardly seen.
41	μ Virginis	14 37 16	95 11	White star. Spectrum with a dark line about F suspected. Bluish tint extending over a great portion of the spectrum.
42	α Libræ	14 44 48	105 35	White star. Spectrum with dark lines about C, F, and G; the two last very thick and prominent. C only visible at the edges of the spectrum. Bluish tint pervades.
43	β Lupi	14 51 20	132 41	Continuous spectrum.
44	δ Libræ	14 55 6	98 5	Yellowish star. Spectrum with extremely fine dark lines suspected.
45	β Libræ	15 11 5	98 59	White star. Spectrum with dark lines about C, F, and G, and one far in the violet. Several extremely fine dark lines in the bluish green suspected.
46	2 Lupi	15 11 8	119 45	Yellowish star. Continuous spectrum.

No.	Star's Name.	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
47	ζ Libræ	15 22 3	106 20	Yellowish star. Continuous spectrum.
48	37 Libræ	15 28 8	99 41	White star. Spectrum very faint; the four hydrogen lines suspected. Bluish tint pervades the spectrum.
49	γ Libræ	15 29 22	104 25	White star tending to yellowish. Spectrum with faint dark lines suspected. Blue predominates; yellow and violet not seen.
50	η Libræ	15 37 53	105 19	White star. Continuous spectrum. Blue predominates; violet not seen.
51	μ Serpentis	15 43 53	93 6	White star. Spectrum with a dark line about F. Bluish tint pervades the spectrum.
52	β Trianguli	15 45 29	153 5	Spectrum with many faint dark lines; one dark line about F more prominent.
53	λ Libræ	15 46 57	109 50	White star. Continuous spectrum. Blue colour abounds; violet and yellow hardly seen.
54	θ Libræ	15 47 33	106 24	White yellowish star. Continuous spectrum. Blue tinge pervading the spectrum; violet and yellow not seen.
55	48 Libræ	15 52 2	103 58	White bluish star. Continuous spectrum. Bluish tint pervading the spectrum; violet not seen.
56	π Scorpii	15 52 12	115 48	Spectrum with very fine lines suspected. Violet abounds.
57	β Scorpii	15 59 2	109 30	Continuous spectrum.
58	ν Scorpii	16 5 36	109 10	White star. Continuous spectrum. Slight tinge of blue over green and yellow.
59	δ Ophiuchi	16 8 35	93 25	White yellowish star. Spectrum with extremely fine dark lines in the blue, and one about C.
60	ϵ Ophiuchi	16 12 30	94 25	Yellowish star. Spectrum with very fine faint lines difficult to see.
61	σ Scorpii	16 14 30	115 20	White star. Continuous spectrum. Violet colour in large proportion.
62	ψ Ophiuchi	16 17 40	109 47	Continuous spectrum. Red very intense.
63	χ Ophiuchi	16 20 39	108 12	Continuous spectrum. Red in large proportion.
64	Scorpii, B.A.C. 5508	16 24 12	124 28	White bluish star. Spectrum with dark lines about C, F, and G suspected. Bluish tinge extending over a great part of the spectrum.
65	23 τ Scorpii	16 29 2	117 59	Whitish star. Spectrum with very fine dark lines suspected. Bluish tinge pervading.

No.	Star's Name.	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
66	Aræ B.A.C. 5554	16 33 18	150 42	Spectrum extremely faint—beyond reach of the instrument. Star $6\frac{1}{2}$ mag.
67	η Ophiuchi	17 4 4	105 35	Spectrum with dark lines; one about C faint; one about G thick and prominent, and a similar one in the violet.
68	36 θ^1 Ophiuchi	17 8 35	116 26	Faint spectrum with many very fine and faint dark lines in the red and blue suspected.
69	ζ Apodis	17 10 30	157 39	Yellowish star. Continuous spectrum.
70	41 Ophiuchi	17 10 58	90 19	White star. Spectrum with dark lines about C, F, and G uncertain. Spectrum very faint. Violet colour not seen.
71	ξ Ophiuchi	17 14 24	111 0	Spectrum with dark lines about F and G. Others suspected. Blue colour predominates.
72	Stone 9445	17 14 57	114 48	Yellowish star. Spectrum with very fine dark lines suspected.
73	θ Ophiuchi	17 15 15	114 53	White bluish star. Spectrum with dark lines about C, F, G, and H; the last two very distinct; the others uncertain. Bluish tint over a great portion of the spectrum.
74	γ Aræ	17 16 8	146 16	Continuous spectrum. Blue and green occupy three-fourths of the total length.
75	45 Ophiuchi	17 20 21	119 46	White bluish star. Spectrum with dark lines about F and G. Blue preponderates.
76	υ Scorpii	17 23 17	127 12	Spectrum with several very faint dark lines suspected in the red and orange, and one near G.
77	α Aræ	17 23 21	139 47	White star. Continuous spectrum. Slight tinge of blue seems to extend over the green and yellow.
78	Stone 9585	17 28 58	128 33	Spectrum with three uncertain bands or groups of dark lines about E, F, and G.
79	ξ Serpentis	17 31 17	105 20	Spectrum with dark lines. A fine one about C; one broad and marked about G; one also broad, but not so marked, far in the violet.
80	ι Scorpii	17 39 54	130 5	Continuous spectrum. Yellow colour almost totally absent.
81	Scorpii, B.A.C. 6018	17 42 22	127 0	Yellowish star. Spectrum with many very faint dark lines difficult to see.
82	ν Ophiuchi	17 52 58	99 46	Yellowish star. Continuous spectrum.
83	π Pavonis	17 57 59	153 40	White star. Spectrum with dark lines about C, F, and G. The C line very difficult. F and G very thick and prominent.

No.	Star's Name.	α 1890·0. h m s	N.P.D. 1890·0. ° ′	Description of Spectra and other Remarks.
84	θ Aræ	17 58 4	140 6	White star. Spectrum with fine dark lines suspected.
85	ε Telescopii	18 3 4	135 58	Yellowish star. Continuous spectrum.
86	μ Sagittarii	18 7 11	111 5	Whitish star. Spectrum with excessively fine dark lines very difficult to see.
87	η Serpentis	18 15 37	92 56	Yellowish star. Continuous spectrum.
88	α Telescopii	18 18 49	136 2	White star. Spectrum with dark lines about F and G faint; other lines suspected.
89	ζ Telescopii	18 20 21	139 8	Yellowish star. Continuous spectrum.
90	λ Sagittarii	18 21 11	115 29	Spectrum with extremely fine lines suspected.
91	ζ Pavonis	18 30 11	161 31	White yellowish star. Spectrum with very fine dark lines.
92	ζ Sagittarii	18 55 37	120 2	White bluish star. Spectrum with dark lines about C, F, G, and one in the violet. C difficult; F very thick and prominent.
93	ε Pavonis	19 47 51	163 12	White bluish star. Spectrum with dark lines about C, F, and G. C double line difficult; F very broad but not prominent. Faintly defined.
94	α Pavonis	20 16 56	147 5	Spectrum with dark bands and lines. Very thick dark band or group of dark lines far in the violet. Other similar band about G not so thick and rather indistinct. Dark band or group of dark lines about F. This is the best defined, but not conspicuous.
95	α Toucani	22 10 58	150 48	Spectrum with dark lines about F and G well seen; others uncertain. White star.
96	γ Aquarii	22 15 58	91 56	White bluish star. Spectrum with dark lines about C, F, and G, and other fainter ones suspected in the blue. Bluish tinge over spectrum.
97	55 ζ Aquarii	22 23 10	90 35	White bluish star. Spectrum with dark lines about F and G, and others suspected in the blue. F thick. Bluish tinge over spectrum.
98	δ^2 Gruis	22 23 11	134 19	Spectrum with flutings; two in the red very marked; a fainter one in the yellow; three very prominent in the blue. Several dark bands in the violet, and many fine dark lines all over. Flutings fade away towards the red end of the spectrum.
99	η Aquarii	22 29 42	90 41	White bluish star. Spectrum with dark lines about F and G; both thick. Several other faint dark lines in the green and blue.
100	λ Aquarii	22 46 52	98 10	Yellowish star. Spectrum with many dark lines in all colours, several of which are very prominent, like the solar spectrum.

Spectroscopic Observations of the Motion of Stars in the Line of Sight made at the Temple Observatory, Rugby. By Geo. M. Seabroke.

The following observations are intended to be in continuation of similar ones communicated to the Society in the years 1879 and 1887; and in vol. xlvii. page 93 of the *Monthly Notices* will be found a description of the telescope and spectroscope used prior to the commencement of the present year.

Those observations recorded as made with two prisms are made with a new spectroscope constructed by me some months ago, and consisting of a collimator of 18 inches focal length and $1\frac{1}{2}$ inch in diameter, a similar lens in the observing telescope, and two prisms of an angle of 45°. The focal length of the eye-piece is about $\frac{1}{3}$ inch.

The measures were made by a pointer of tinfoil, set edgewise to the line of sight, alternately on the star line and line from the hydrogen tube or magnesium wire respectively, and recording the distance moved by the pointer by readings of the micrometer screw.

The pointer is illuminated by light reflected upon it from a small reflector close to the eye.

Owing to my want of practice with a pointer of this form, and certain wants of adjustment in illuminating the pointer equally at both edges, my early readings vary *inter se*, and the observations are therefore of little value; but of late the measures are much more accordant. By reducing the number of prisms in the new instrument as compared with the old one, the illumination of the spectrum is much increased, while the power of comparison is retained by increase of focal length and diameter of the collimator.

A marked excess of − motion over + is to be remarked; and although I can give no reason for any systematic error in the former direction, I feel that the observations hereafter recorded should be received with caution.

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			Andromedæ.		
5	F	4	+32·6	87·084	
5	F	3	−46·7	·928	
5	F	4	−29	·955	
5	F	3	−68·8	·958	
2	F	2	−56·2	88·972	
2	F	4	−30·5	89·825	
			γ Pegasi.		
5	F	4	−51·2	87·903	
5	F	3	−23·1	·955	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			β Andromedæ.		
5	F	2	+13·7	87·084	
5	F	4	−37·9	·110	
5	F	3	−35·5	·120	
5	F	3	−16·3	·125	
			β Arietis.		
5	F	3	−46·1	87·928	
5	F	4	−62·6	88·076	
5	F	1	−34·5	·024	
			γ Andromedæ.		
5	F	3	−45·2	87·084	
5	F	4	−38·9	·110	
5	F	3	−27·2	·125	
5	F	2	−38·7	88·172	
			α Arietis.		
5	F	4	−47·9	87·084	
5	F	2	−34·5	·104	
5	F	4	−36·7	·110	
5	F	3	−32	·120	
5	F	2	−30·9	·928	
5	F	3	−20·5	88·076	
			Algol.		
5	F	4	−28·2	87·125	
5	F	5	−45·2	·150	
5	F	3	−51·1	·158	
5	F	2	−39·4	·167	
5	F	4	−22·5	·928	
5	F	3	−31·2	88·076	
5	F	5	−54·6	·172	
5	F	3	−47·5	·197	
2	F	3	−88·5	89·123	
			α Persei.		
5	F	4	−35·4	87·110	
5	F	3	−44·7	·120	
5	F	6	−37·7	88·172	
5	F	1	−33·0	·197	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			Aldebaran.		
5	F	3	+ 8·7	87·158	
5	F	3	+ 7·7	88·172	
5	F	1	− 7·3	·197	
			α Aurigæ.	.	
5	F	3	−59·4	87·120	
5	F	5	−36	·125	
5	F	1	−18·3	·150	
5	F	2	−12·5	·158	
5	F	4	− 3	·287	
5	F	4	−22	·298	
5	F	5	−13	88·172	
5	F	2	+ 8·5	·314	
5	F	4	+ 5	·328	
5	F	4	+12	·334	
2	F	5	−41·3	89·123	
5	F	3	+13·7	·227	
5	F	4	−39·8	·238	
			Rigel.		
5	F	2	+21·6	87·084	
5	F	4	+ 0·9	·110	
5	F	2	+ 2·3	·104	
5	F	4	+ 2·5	88·197	
5	F	2	− 3·5	·216	
			γ Orionis.		
5	F	3	−24	87·158	
5	F	3	− 8·5	88·197	
			β Aurigæ.		
5	F	4	−42·7	87 287	Line diffuse.
5	F	4	−55·3	88·328	,,
5	F	2	−41·2	·334	
5	F	4	−54·3	·347	
5	F	3	−62	89 227	
			β Tauri.		
5	F	3	+ 5·8	87·287	
5	F	4	+21·1	·298	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			Sirius.		
5	F	3	− 44·1	87·110	
5	F	2	− 22·5	·125	
5	F	4	− 31·3	·150	
5	F	3	− 47·7	·158	
5	F	4	− 19·5	88·172	
5	F	2	− 38·7	·199	
5	F	4	− 49·8	·216	
2	F	6	−174·6	89·104	New spectroscope, obviously in error.
2	F	...	−123·7	·123	
			Castor.		
5	F	3	−14	87·287	
5	F	4	−51·7	·350	
5	F	3	−49·4	·353	
5	F	3	−48·6	88·314	
5	F	4	−25·9	·328	
5	F	2	− 4·2	·334	
5	F	4	+12·7	·347	
2	F	3	− 148	89·227	New spectroscope; error.
			Procyon.		
5	F	3	−10·8	87·287	
5	F	5	−21·6	·298	
5	F	3	−37 5	·350	
			Pollux.		
5	F	2	−18·2	87·353	
5	F	3	+ 2·9	88·314	
5	F	2	−48·6	·328	
5	F	1	−22·8	·334	
5	F	4	−33 4	·347	
			η Leonis.		
5	F	2	0	88·334	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800 +	Remarks.
			α Leonis.		
5	F	7	−21·5	87·350	
5	F	6	−47·2	·353	
5	F	4	+22·9	·374	
5	F	4	− 7·0	88·325	
5	F	5	−68·5	·328	
5	F	4	−58·3	89·232	
5	F	4	−36·4	·342	
5	F	2	−27	·382	
5	F	4	−40·6	·383	
			γ Leonis.		
5	F	1	− 0·3	87·350	Line barely visible.
5	F	4	−15·8	88·394	„ „
			α Ursæ Majoris.		
5	F	5	+ 5·5		
5	F	4	− 4·1		
			γ Ursæ Majoris.		
5	F	4	−26·6	87·520	
5	F	4	−19·3	·550	
5	F	4	−31·5	89·386	
2	F	4	85·5	·388	Line badly defined.
2	F	3	−75·8	·427	New spectroscope; probably in error.
			β Ursæ Majoris.		
5	F	3	− 9·5	87·52	
5	F	4	+ 3·0	·55	
5	F	3	− 45·8	89·386	
5	F	5	− 64·7	·388	
2	F	4	− 39	·427	
2	F	4	− 82	·446	
			δ Leonis.		
5	F	3	− 24	88·394	Line diffuse.
5	F	4	−107	89·380	„
5	F	4	− 74·6	·383	„
			θ Leonis.		
5	F	4	− 24	...	Line faint.
5	F	3	− 35	...	„
5	F	4	+ 12·7	...	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			β Leonis.		
5	F	5	− 30·8	87·443	Line very diffuse.
5	F	5	− 19·3	88·394	
5	F	4	− 83·5	89·380	
5	F	4	− 32·2	·383	
			δ Ursæ Majoris.		
5	F	3	− 33·9	87·520	
5	F	4	− 10·8	·550	
2	F	2	− 33·0	89·418	
			ε Ursæ Majoris.		
5	F	4	− 15·3	87·484	
5	F	4	− 19·8	·520	
5	F	3	− 19·7	·580	
5	F	4	− 55	89·386	
5	F	4	− 95·5	·388	
2	F	3	− 40·2	·418	
2	F	4	− 83·2	·465	
			ξ Ursæ Majoris.		
5	F	4	− 11·6	87·550	
5	F	5	− 42·2	·580	
5	F	3	− 61·3	89·386	
2	F	5	− 21	·465	
			α Virginis.		
5	F	4	− 17·1	87·353	
5	F	4	− 0·5	·374	
5	F	7	− 51·9	·443	
5	F	3	− 4·2	89·383	
			η Ursæ Majoris.		
5	F	3	− 28·5	87·457	
5	F	3	+ 2·7	·550	
5	F	4	+ 1·3	·580	
5	F	2	− 28·9	·640	
5	F	2	− 32·5	89·383	
2	F	4	− 65·5	·418	New spectroscope; doubtful.
2	F	5	− 7·7	·468	,,

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			Arcturus.		
5	b_1	5	+ 7·1	87·353	
5	b_1	6	+ 8·1	·374	
5	b_1	4	− 44·3	·434	
5	b_1	4	− 28·1	·443	
5	b_1	2	− 23·1	·451	
5	F	1	− 35·0	88·380	
			α Coronæ Borealis.		
5	F	4	− 11·3	87·550	
5	F	5	− 57·4	·640	
5	F	2	− 22·2	·680	
5	F	4	− 35·7	·750	
5	F	1	− 45·0	89·380	
2	F	2	− 56·5	·427	
2	F	5	− 59·3	·506	
2	F	4	+ 9·0	·544	
			α Ophiuchi.		
5	F	2	− 20·8		
5	F	3	− 25·7		
5	F	4	+ 9·0		
2	F	4	+ 23·0	...	New spectroscope; doubtful.
			Vega.		
5	F	6	+ 24·0	87·740	
5	F	5	− 64·1	·770	
5	F	5	− 53·1	·791	
5	F	3	− 29·7	·802	
5	F	3	− 56·0	·810	
5	F	5	− 67·1	·829	
5	F	4	− 21·2	88·794	
5	F	3	− 33·7	·796	
5	F	4	− 43·0	·804	
2	F	5	− 39·6	89·506	
2	F	4	− 55·0	·544	
2	F	4	− 63·3	·654	
2	F	4	− 50·1	·657	
2	F	4	− 73·2	·659	
2	F	3	− 46·5	·681	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			γ Lyræ.		
5	F	5	+ 6·3	87·791	
5	F	3	− 33·4	·802	
5	F	3	− 27·5	·810	
5	F	2	− 27·5	·829	
5	F	2	− 14·8	88·796	
5	F	3	− 72·5	·804	
			ζ Aquilæ.		
5	F	3	− 27·9	87·791	
5	F	4	− 15·5	·802	
5	F	4	− 51·9	·810	
			γ Aquilæ.		
5	F	3	− 24·6	87·802	
5	F	4	+ 4·7	·810	
			δ Cygni.		
5	F	4	+ 14	87·791	
5	F	4	− 29·7	·802	
5	F	4	− 25·0	·810	
5	F	4	− 30·4	·903	
5	F	3	− 28·1	88·796	
2	F	3	− 53·5	89·679	New spectroscope ; doubtful.
2	F	5	− 49·5	·690	,,
			Altair.		
5	F	4	− 23·5	87·791	
5	F	4	− 28·3	·810	
5	F	3	− 34·5	88·794	
5	F	4	− 39·5	·796	
5	F	2	− 82 7	·804	
2	F	4	+ 2·5	89 796	
2	F	4	− 34·5	·659	
			θ Aquilæ.		
3	F	8	+ 34·5	86·75	

Number of Prisms.	Line Compared.	Number of Measures.	Cor. Motion in Miles per Second.	Date 1800+	Remarks.
			γ Cygni.		
5	F	4	− 22·0	86·96	
5	F	4	− 31·4	·96	
5	F	4	− 47·1	87·791	
5	F	3	− 24·2	·802	
5	F	4	− 37·2	·810	
2	F	3	− 21·0	89·777	
2	F	4	− 34·5	·796	
			α Cygni.		
3	F	4	− 17·0	86·93	
5	F	4	− 36·5	·96	
5	F	4	− 55·3	·96	
5	F	3	+ 21·1	87·791	
5	F	4	− 28·3	·870	
5	F	4	− 25·3	·903	
5	F	3	− 20·4	88·794	
5	F	2	− 58·0	·796	
2	F	5	− 16·0	89·777	New spectroscope; doubtful.
2	F	4	+ 7·0	·796	,,
			ε Cygni.		
3	F	2	− 27·0	86·93	
5	F	4	− 33·9	87·810	
5	F	2	− 16·3	·955	
2	F	3	− 39·0	89·796	
			ε Pegasi.		
5	F	4	+ 10·3	87·902	
5	F	4	+ 6·7	·955	
5	F	4	+ 10·2	·958	
			η Pegasi.		
3	F	2	− 17·7	86·93	
			α Pegasi.		
5	F	2	− 26·3	86·96	
5	F	5	− 27·8	87·870	
5	F	4	− 40·5	·903	
5	F	3	− 38·0	·950	
5	F	4	− 17·0	·955	
2	F	3	− 47·0	89·177	
2	F	4	+ 10·0	·835	
			β Pegasi.		
5	b_1	2	+ 41·1	86·96	
5	b_1	2	+ 16·6	·96	

On the Orbit of Struve 228. By J. E. Gore.

Recent measures show that this binary star has described about 120° of its apparent orbit since its discovery by Struve in 1829. I have computed the orbit by Professor Glasenapp's method, combined with Kowalsky's equations, and find the following provisional elements :—

Elements of Σ 228.

P = 88·73 years	Ω = 84° 49′
T = 1906·03	λ = 51° 36′
e = 0·5311	a = 0″·98
i = 70° 59′	μ = +4°·057

P and T were computed by the formulæ :—

$$T = \frac{t'+t}{2} - \frac{M'+M}{M'-M} \cdot \frac{t'-t}{2}$$

$$P = \frac{360^\circ}{\mu}\,;\ \mu = \frac{M'-M}{t'-t}$$

where M and M′ are the mean anomalies, computed from the geometrical elements, for the epochs t and t' and the corresponding values of θ, derived from the earlier and later observations.

The following is a comparison between the recorded measures and the positions computed from the above elements. The observed position-angles have been corrected for the effect of precession to 1880·0 :—

Epoch.	Observer.	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ_c	$\rho_o - \rho_c$
1829·16	Struve	264°·21	258°·47	+ 5°·74	1″·08	0″·83	+0″·25
1831·75	„	262·41	262·50	− 0·09	1·22	0·96	+0·26
1832·02	„	259·00	262·80	− 3·80	1·14	0·99	+0·15
1832·20	„	263·50	263·00	+ 0·50	0·93	1·05	−0·12
1832·21	„	262·60	263·01	− 0·41	1·03	1·05	−0·02
1841·94	O. Struve	274·88	271·36	+ 3·52	1·32	1·20	+0·12
1852·19	Mädler	280·32	278·80	+ 1·52	1·11	1·18	−0·07
1856·76	Dembowski	281·12	282·48	− 1·36	1·0	1·12	−0·12
1857·21	Mädler	284·23	282·87	+ 1·36	0·9	1·11	−0·21
1862·96	Dembowski	286·57	288·57	− 2·00	0·9	0·98	−0·08
1866·07	„	291·66	292·45	− 0·79	0·947	0·89	+0·057
1869·48	Dunér	299·54	297·64	+ 1·90	0·71	0·78	−0·07
1870 18	O. Struve	299·64	298·93	+ 0·71	0·86	0·76	+0·10
1873·81	Dembowski	304·40	306·80	− 2·40	0·64	0·65	−0·01
1874·94	Gledhill	307·22	309·83	− 2·61	0·6	0·61	−0·01

Epoch.	Observer.	θ_o	θ_c	$\theta_o - \theta_c$	ρ_o	ρ_c	$\rho_o - \rho_c$
1875·20	Dunér	311°·42	310°·58	+ 0°·84	0″·52	0″·60	− 0″·08
1876·89	Dembowski	314·92	315·85	− 0·93	0·522	0·55	− 0·028
1878·90	Doberck	327·71	323·92	+ 3·79	0·47	0·49	− 0·02
1883·50	Engelmann	348·29	349·41	− 1·12	0·311	0·40	− 0·089
1888·142	Schiaparelli	33·60	22·33	+ 11·27	0·35	0·39	− 0·04
1888·171	Tarrant	17·23	22·54	− 5·31	0·43	0·39	+ 0·04
1888·696	„	21·31	26·10	− 4·79	0·40	0·40	0·00
1888·778	„	21·54	26·61	− 5·07	0·46	0·40	+ 0·06
1888·931	Schiaparelli	25·73	27·63	− 1·90	0·36	0·40	− 0·04
1889·018	„	30·25	28·23	+ 2·02	0·35	0·40	− 0·05
1889·021	Young	34·56	28·24	+ 6·32	0·41	0·40	+ 0·01
1889·570	Tarrant	26·97	31·76	− 4·79	0·37	0·41	− 0·04

The recent measures by Professors Schiaparelli and Young and Mr. Tarrant were kindly communicated to me by private letter.

According to the above orbit the distance between the components will gradually increase during the next few years, up to a maximum of about 0″·55, and then diminish again as the companion approaches the periastron. The minimum distance will not be reached till the position-angle is nearly 180° (after the periastron passage), when the components will probably be separated by less than 0″·2. Careful measures during the next sixteen years will be very valuable for correction of the provisional elements.

On the supposition that the combined mass of the components is equal to the mass of the Sun, the "hypothetical" parallax would be

$$\pi = \alpha P^{-\frac{2}{3}} = 0''{\cdot}05$$

The binary lies a little preceding 62 *Andromedæ*, and its position for 1890·0 is approximately :—

R.A. $2^h\ 6^m\ 59^s$, Decl. + 46° 58′·4

The magnitudes of the components are about 6·7 and 7·6.

A Method of Recording the Transits of Stars by Photography.

By W. E. Wilson.

I wish to bring before the notice of the Society a method by which the transits of stars can be recorded by photography and the personal errors eliminated. If a sensitive photographic plate is placed in the focus of a transit instrument close behind the wires, and the image of a star of suitable magnitude allowed to transit across it, the result is a straight black line on developing the

plate. If instead of having the plate fixed, we have it so arranged that it can be given a small up-and-down motion each second, the result on the plate is a broken line, thus, ⁻_⁻_⁻ _⁻_⁻_, the breaks in which are equal to seconds of time. The motion is given to the plate by an electro-magnet driven by a current sent by the observatory clock. During or after the transit a light from a small electric lamp is allowed to fall through the object-glass on the plate for a few seconds. This gives an impression of the wires superposed on the star transit. With a rough apparatus I find the time of transit can be recorded to $\frac{1}{4}$ second, and I believe with some care the time could be taken to a very small fraction of a second.

I used for these experiments the 4-inch finder of my 2-foot reflector. The object-glass was not corrected for photographic rays, and the star trail on the plate was therefore not as fine as it would be with a suitable objective.

1889 *December* 12.

Catalogue of Bright Meteors observed at Bristol during the Years 1877 *to* 1889 *inclusive.* By William F. Denning.

There are several reasons which make it desirable to place on record the observed paths of bright meteors. Such materials enable us to determine the epochs which appear to be specially abundant in fireballs, and may also serve in the determination of their radiants. Moreover, the publication of such data is useful as a means of comparison amongst different observers, several of whom may have registered the same objects.

The following catalogue includes 217 fine meteors, chiefly as bright as *Jupiter* or *Venus*. The radiant points affixed may be generally relied upon, but it is necessary to say that in some cases there is uncertainty, notwithstanding strong presumptive evidence afforded by the flight-directions and appearance of the meteors, that they diverged from the centres assigned.

This catalogue is supplementary to the "List of observed Courses of 71 Bright Shooting Stars seen at Bristol during the Period from November 1872 to March 1876" (*Monthly Notices*, vol. xxxvi. pp. 285–9), and to the "List of observed Paths of 85 Bright Shooting Stars recorded during the Nine Months April to December 1876" (*Monthly Notices*, vol. xxxvii. pp. 112–5). In these lists I included all meteors equal to 1st magnitude stars, but in the present catalogue I have omitted these, owing to the very large number of such observations which I have accumulated during the last thirteen years. To have given them would have swelled the catalogue to an immoderate length.

Catalogue of 217 *Bright Meteors observed at Bristol during the years* 1877 *to* 1889.

(Continued from *Monthly Notices*, vol. xxxvii. p. 115, January 1877.)

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1877 Jan. 4	8 51	> ♀	134	+45	169	+44	25	57	−12	Slow. Duration, 2½ sec.
14	14 44	♃	195	+68	264	+48	39	130	+44	Swift; streak 15° 3 sec.
May 30	11 26	♃*	333	+27	324	+14	15	20	+58	Slow; streak; yellow.
July 6	12 5	♃	326	+60	350	+60½	12	χ Cygni		Swift; inexact. In clouds.
Aug. 7	10 54	♃	346	+22	329	− 1	28	40	+56	Swift; streak; D. 0·7 sec.
10	10 26	♃	165	+79	198	+61	21	43	+58	Swift; streak; D. 0·5 sec.
10	11 51	♃	77	+55	96	+48	13	43	+58	Swift; streak; D. 0·3 sec.
10	12 57	> ♀	69	+35	76	+25	12	43	+58	Swift; streak 30 sec.; D. 0·3 sec.
10	14 4	♃	96	+43	106	+35	11	43	+58	Swift; streak; 3° for 20 sec.
10	14 30	♃	53	+35	56	+25	11	43	+58	Swift; streak 25 sec.; D. 0·4 sec.
Sep. 15	12 21	♃	56	± 0	55	− 6	6	61	+36	Swift; streak 4 sec.
15	15 30	♃	139	+78	282	+87	15	130	+46	Swift; streak.
16	14 42	♃	73	+ 5	60	− 5	16	88	+17	Swift; streak.
Oct. 2	8 59	♀	325	+67	354	+48	24	225	+52	Slow; streak 3½ minutes; D. 1·5 sec.
2	9 47	♃	203	+40	198	+36		225	+52	Slow; D. 1 sec.
3	8 38	♀	155	+64	152	+55	10	160	+78	Swift; streak 2° for 15 sec.
7	9 14	♃	310	+60	319	+55½	6½	299	+64	Slow; streak; D. 0·7 sec.
8	11 50	♃ ♀	109	+17	116	+12	8	77	+32	Very, very swift; streak 4° 2 sec: D. 0·2 sec.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
			°	°	°	°		°	°	
1877 Oct. 8	13 35	4	46	+50	346	+32	47	108	+38	Slowish; streak 25°; D. 1·3 sec.
15	16 25	4	222	+83	263	+76	10½	133	+79	Very swift; streak 3°; D. 0·2 sec.
16	13 18	4	105	+39	116	+50	13	92	+15	Very swift; streak 5° 3 sec.; D. 0·2 sec.
17	16 29	4	150	+54	186	+56	20	92	+15	Very swift; streak; D. 0·3 sec.
18	16 38	4	26	+43	1	+41	19	92	+15	Very, very swift; streak; D. 0·2 sec.
Nov. 1	8 58	4	44	+56	245	+51	68	43	+22	Slow; yellow; train; D. 3·5 sec.
4	8 7	4	31	+41	59	+69	32	20	+ 8	Slow; star-like; D. 3·5 sec.
4	12 56	4	55	+22	61	+22	5	43	+22	Very slow; streak; D. 2 sec.
Dec. 2	8 20	½ = ☽	334	−11	322	−18½	13	350	− 1	Very slow; 4 bright flashes; D. 3·5 sec.
1878 June 7	9 50	½ = ☽ *	220	−18	151	+15	76	247	−25	Slow; D. 5 sec.
July 21	12 6	4	229	+72	212	+34	38	20	+51	Swift; streak 25°; D. 0·5 sec.
21	12 35	< ♀	219	+41	209	+33	11	242	+51	Not swift; streak; D. 0·4 sec.
27	11 43	4	32	+22	37	+14	10	11	+48	Very slow, on horizon; D. 1 sec.
27	11 45	4	348	+54	321	+47	19	32	+53	Swift; streak 11°; D. 0·5 sec.
30	13 44	♀	330	−22	332	−27	6	325	−12	Swift; streak 4 sec.; D. 0·3 sec.
Aug. 2	11 25	4	356	− 9	353	−12	8	32	+53	Swift; streak; D. 0·3 sec.
8	13 48	4	65	+65	79	+67	6	44	+59	Swift; streak; D. 0·4 sec.
10	9 39	4	321	−10	312	−23	16	44	+59	Swift; streak; D. 0·3 sec.
10	10 46	4	352	+31	340½	+13½	20	44	+59	Not swift; streak 20 sec; D. 0·8 sec.

* Observed also at other stations.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1878 Aug. 10	10 58	4	41	+22	41	+15	7	44	+59	Swift; flash; streak 2°; D. 0·3 sec.
10	11 50	4	354	+66	326	+60	14	44	+59	Swift; streak 10°; D. 0·4 sec.
Sep. 1	10 20	< ♀	161	+70	155	+56	14	315	+76	Swift; streak; D. 0·4 sec.
8	8 35	> ♀	246	+21	244½	+ 5	16	61	+36	Swift; streak 4° 20 sec.; D. 0·4 sec.
25	15 5	4	66	+ 8	61½	− 3	12	87	+42	Very swift; streak 7°; D. 0·2 sec.
Nov. 18	9 50	4 *	47	−26½	50	−27½	3	354	+ 1	Slow; only end seen.
Dec. 21	9 33	♀	13	− 5	11	−19	14	? Ursa		Very swift; streak 1° 7 sec.; D. 0·3 sec.
1879 July 29	12 16	4	140	+66	158	+54	15	32	+53	Swift; bright streak.
Aug. 9	11 52	4	34	+78	254	+85½	15	46	+58	Swift; streak.
12	11 30	4	6	+47	351	+37	15	46	+58	Swift; streak.
22	14 50	< 4	326	+30	325¾	+22	8	330	+69	Slow.
23	9 18	> 4	340	+53	360	+43½	16	291	+60	Slow; train.
23	10 7	4	341	+33	347	+23	11	291	+60	Slow; bright streak 5 sec.
25	9 57	♀	79	+76	89	+67	9	291	+60	Slowish; bright flash and train.
25	12 2	4	334	+59	314	+58½	11	24	+41	Swift; streak.
Sep. 15	9 1	♀	196	+77	267	+54	34	125	+46	Very, very swift; streak; bright flash.
21	13 30	4	112	+58	127	+63	9	87	+42	Swift; streak; bright flash.
21	14 36	♀	28	−19	37	−27	11½	339	+32	Slow; streak; 2 flashes.
25	13 36	♀	48	−16	58	−22	11	339	+32	Streak; 2 flashes.
25	14 39	> 4	116	+36	128½	+28	13	98	+42	Swift; streak.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1879 Oct. 14	15 41	♃	116	+18	117½	+ 4	14	114	+62	Swift; streak.
14	16 45	♀	123	+63	147	+70	12	93	+17	Very swift; bright streak.
15	9 8	♃	98	+76	113	+80	5	78	+57	Slow; bright streak; 4 sec.
15	16 19	♃	151	+41	178	+43	20	106	+23	Swift; streak.
16	7 39	♃	19	+59	348	+36	30	105	+50	Swift; bright streak.
20	7 39	♃	336	+22½	293	+ 15½	41	31	+18	Slow; bright streak.
20	12 15	♃	89	+57	69	+84	27	93	+17	Very swift; streak.
Nov. 10	7 20	♀	213	+56	207	+32	25	7	+51	Slowish.
13	15 6	♃	98	+37	77	+36	17	148	+23	Very swift; streak.
13	16 41	♃	184	+30	193	+30	7½	148	+23	Very swift; streak.
1880 Jan. 2	6 16	♃	253	+44	261	+38	8	228	+54	Slow; flash.
2	7 50	> ♃	138	+41	126	+29	15	228	+54	
2	9 8	> ♃	32	+60	353	+56	20	Auriga		Slow; bright train.
Mar. 29	7 57	> ♃	247	+42	200	± 0	59	297	+52 (?)	Very, very slow; D. 7 or 8 sec.
Apr. 4	10 5	> ♃*	293	+69	246	+53	27	27	+18	Slow; thick train.
May 27	11 10	♃	327	+30	357	+34	26	Ophiuchus		Slow; starlike.
July 29	10 44	> ♃	22	+86	55	+76	11	257	+64	Swift; in haze near *Polaris*.
Aug. 7	12 25	♀	55	+53	64	+50	6	41	+55	Bright streak.

* Observed also at other stations.

Date.	G. M. T.	Mag.	Apparent Path. From α δ	Apparent Path. To α δ	Length.	Radiant Point. α δ	Appearance, &c.
	h m		° °	° °		° °	
1880 Aug. 8	12 49	> ♃	28 +44	24 +39¾	5	41 +55	Bright streak; 2 max.
8	13 37	¼ = ☽	266½ + 7	264½ − 2	5	41 +55	Very swift; streak; bright flash.
9	12 23	> ♀	332 + 7	320 −10	20	44 +55	Streak, bright flash.
9	12 40	♃	122 +73	158 +66½	14	44 +55	Streak.
10	10 29	♃	316 +81	259 +67	19	45 +57	Streak for 6 sec.
10	11 11	♃	327 +55	302 +37	24	45 +57	Streak for 4 sec.
11	9 20	♃	291 +12	292 − 3	15	Ursa or Lynx	Swift; streak.
Sep. 6	10 35	♃	294 + 7½	999 − 8	21	61 +36	Very swift; streak.
Oct. 11	10 24	♃	250 +39	251 +28	11	77 +33	Streak for 20 sec.
23	...	> ♃	8 + 1	353 − 7	17	Aries-Taurus	Streak.
29	9 50	> ♀*	38 +18	26 +22	12	46 +15	Streak; several flashes.
30	7 24	♃	337 +36	343 + 8	28	190 +70	Streak for 7 sec.
Nov. 17	7 47	> ♃	344 − 1	321 −14	26	61 +35	Streak for 4 sec.
27	9 2	> ♃	57 +67	38 +82	15½	63 +21	Streak ½°; bright flash.
1881 July 24	8 53	♃	108 +69	91 +55	15	242 +51	Very slow.
24	13 59	♀	336 − 5	340½ − 4	4½	318 − 9	Streak; vivid flash.
27	12 2	♃	334 +71	282 +61	22	32 +56	Swift; streak.
31	10 57	♃	12 +54	17 +59	6	8 +48 or Pegasus	Slowish; streak 5°.
Aug. 2	10 49	♃	359 +58	341 +56	10	39 +55	Swift; streak 4 sec.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1881 Aug. 2	12 0	< ♃	26½	+44	24	+37	7	39	+55	Swift; streak.
12	11 43	♃	50	+66	93	+65	18	8	+50	Rather swift; streak.
21	8 50	> ♀	200	+48	178	+29	25	291	+60	Slowish.
27	12 0	> ♃	26	+68½	64	+68	14	331	+37	Slow; sparks.
1882 Aug. 6	10 35	♃	328	+70	297	+62	15	42	+57	Swift; streak.
Nov. 6	16 36	♃	146	+41	183	+18	39	{61 / 43}	{+35 / +22}	Slowish; bright spark train.
1883 July 28	10 36	♃	23	+44	22	+40	4	27	+55	Slow; streak 3 sec.
28	11 10	♀	320	+11	305	−13	28	27	+55	Swift; streak 20 sec.
28	13 37	♃	351	+ 5	357	+11	9	337	−11	Slow.
Oct. 17	9 33	♀	259	+48½	241½	+24	28	40	+20	Slow; 3 flashes; streak 4 sec.
26	9 17	½ = ☽	288	+56	333	+59	24	254	+37	Streak; 4 flashes.
Dec. 6	12 17	♃	348	+32	334½	+27½	12	80	+23	Slow; streak 10 sec.
1884 Jan. 6	5 33	♃	298	+32	303	+13	19	290	+52	Slow.
July 25	13 0	♃	341	+34	337	+27¼	11	48	+43½	Swift; streak; flash.
Aug. 16	9 52	♃	52	+63	51	+67	4	53	+58	Slow; bright streak.
23	10 46	♃	45	+19	23	+29	15	41	+15	Slow; dense streak.
23	13 21	♃	40½	+53	80	+88	35	41	+15	Swift; dense streak.
26	11 4	♃	350	+28½	312	+23½	34	46	+18	Swift; streak.
Nov. 21	10 10	♃	137	+51	160	+48½	15	62	+22	Swift; flash inexact.

* Observed also at other stations.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1885 Apr. 18	12 57	4	215	− 4	203	−17	18	260	+ 33½	Not swift; bright flash and streak.
20	13 14	4	207½	+ 3¼	194	− 5½	16	274	+ 33½	Very swift; flash and streak.
20	14 1	4	214	−10	208	−15⅓	8	274	+ 33½	Very swift; flash.
July 8	12 1	4	240	+61	218	+37	27	11	+ 48	Very swift; bright streak.
8	12 10	4	297	+69	301	+71	2½	290	+ 60	Very slow; thick train.
9	13 45	4	300	+ 9	298¾	+ 22	13½	304	− 15	Rather slow.
Aug. 8	12 54	4	7	+43½	353	+31	17	43	+ 57	Swift; streak.
15	11 44	4	297	+73½	268	+57	19	48	+ 57	Swift; bright streak.
17	10 59	4	346	+59	318	+46	21	55	+ 56	Swift; streak.
Sep. 9	15 48	4	149	+82	152	+64	18	335	+ 71	Not very swift; streak.
15	15 11	4	37	+ 6½	26⅓	+ 7	10½	70	+ 4	Swift; bright streak 10 sec.
Oct. 7	10 51	4	51½	+ 22	71½	+ 24	18	31	+ 18	Slow; train.
8	15 9	4	155	+53	162½	+46½	8	42	+ 55	Swift; bright streak and flash.
12	14 26	♀	119	+51	151	+60½	20	88	+ 18	Swift; bright streak.
12	14 26	4	119½	+50	143	+60½	16½	103	+ 33	Swift; bright streak.
16	16 35	4	213	+47½	226	+41	11	143	+ 49	Swift; streak; disc.
Nov. 15	14 18	4	197	+62	212	+47	17	60	+ 28	Slow; 3 max.
26	8 42	4	48	+40	61	+36	11	26	+ 44	Very slow; train.
26	10 9	4	158	+73½	177	+60½	14½	26	+ 44	Thick train; flash.
27	5 22	♀	62	+52	85	+50½	14½	24	+ 44	Slow; train.

Date.	G. M. T.	Mag.	Apparent Path. From α δ	Apparent Path. To α δ	Length.	Radiant Point. α δ	Appearance, &c.
	h m		° °	° °		° °	
1885 Nov. 27	5 29	♀	20 +25	18½ +13	12	24 +44	Slow; train.
Dec. 9	16 30	♃	35 +56	38½ +38	17	27 +71	Slow; streaky train.
1886 Jan. 2	7 8	♀	225 +47	224 +44	3	228 +52	Very slow; 3 outbursts.
4	11 14	♀	164 +58	215 +52	29	133 +49 (?)	Slow; halting; 3 max.
June 4	12 35	♃	331 +31½	329 +39	7½	333 +27	Very slow; 2 max.; bright streak.
July 21	10 53	♃	349 +9	346¼ +1	8½	20 +58	Swift; streak; flash.
Aug. 4	10 40	♃*	129 +60	83 +40	34	162 +59	Very, very slow; D. 8 sec.
6	10 3	♃	352 +13	320 +3	32	{31 +18 / 42 +20}	Slow; bright streak.
10	9 53	♃	42 +72	49 +84	12	44 +57	Slow; broken streak.
10	13 34	> ♀*	77 +67	111 +67	13	44 +57	Swift; streak 3½ min.; flash.
Sep. 7	13 39	♀	146 +78	205 +74	15	δ Aurigæ	Very swift; streak; 2 max.
22	10 26	♃	50 +20	42 +18	7½	63 +23	Slowish; bright streak.
27	15 21	♃	16 +46	17½ +61	15	14 +12	Slowish; train.
Oct. 23	9 40	♃	116 +59	155 +49	24½	31 +19	Very slow; flash at end.
Nov. 2	11 48	♃	21 +52	2½ +45	14	97 +42	Very swift; streak.
3	11 49	♃	20 +23½	10 +19	10½	60 +34	Not swift; train; flash.
17	7 18	> ♀*	32½ +45	158 +55	63	34 +19	Very slow; train; D. 7 sec.
Dec. 4	9 17	♀*	184 +52½	195 +47	9½	162 +58	Rather swift; streak 1½ min.
5	15 20	♃	182½ +34½	191 +31½	8	155 +40	Very swift.
18	11 14	♀	194 +58	193¼ +53	5	195 +68	Not swift.

* Observed also at other stations

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1887 Jan. 20	6 48	4	146	+36	168	+35	18	116	+30 (?)	Very, very slow; D. 5 sec.
Feb. 2	15 44	4	68	+84	60	+68	16	θ Draconis (?)		Not very swift.
Mar. 28	12 53	4	333	+50	345½	+40	13½	263	+62	Rather swift.
Apr. 19	13 13	♀	269	+11	269	+ 1	10	269	+31	Swift; streak.
19	13 46	4	308	+61½	56	+65½	42	280	−14	Swift; streak.
June 14	13 5	♀	349½	+68	300	+87½	20	353	+38	Very swift; streak 5 sec.
23	9 47	4	311	+ 9	346	+15	35	Serpens-Libra		Very slow.
23	11 54	4	173	+55	148	+53	15	252	+11	Very slow.
25	12 54	4	38	+48	39	+42½	5½	40	+56 (?)	Slow; bright streak 5 sec.
July 22	10 59	4	16	+41	16½	+51	10	16	+31	Slow; very bright streak.
22	12 21	4	356	+45	332	+29	24½	25	+52	Swift; bright streak.
22	12 25	4	344	+33	320	+29	20½	16	+31	Swift; bright streak.
22	13 15½	4	323	+37	355½	+10½	39	271	+48	Not swift.
27	10 40½	4	325	+ 6	330	+ 8	5	322	+ 4	Very slow; streak 4 sec.
27	13 21	4	319½	+16½	308	+32	19	337	−12	Not swift; streaky train.
29	11 28	4	66	+72½	114	+70	15½	20	+57	Swift; streak.
Aug. 1	12 18½	♀	338	+43	164	+70	67	337	−12	Slowish; streak 5 sec.
6	11 29	4	25	+86½	213	+72	22	31	+49	Swift; streak.
7	11 49	4	79	+39	92	+34	11	333	+12	Slow; starlike.
8	10 34	4	6	+67½	302	+60½	27	43	+56	Swift; streak.
8	11 28	♀	349	+15	9	+14¼	20	304	+11	Rather swift.
11	10 51	4	31	+45	26	+37½	8	45	+57	Swift; streak.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1887 Aug. 14	13 53	4	20	+35	6	+14	24	53	+57	Swift; streak.
20	11 22½	4	60	+54	41	+65	14½	73	+41	Rather swift; bright streak.
21	11 2	♀*	230	+61	218	+59	6	262	+61½	Slow; bright streak.
25	11 9	4	328	+22	326½	+ 3	19	334	+58	Rather swift; streak or train.
30	14 25	♀	19	+27	5	+14	18½	46	+43	Swift; bright streak.
Sep. 17	10 37	4	51	+18	66	+24¾	15½	31	+ 8	Slow; train.
17	13 26	4	45½	+34	19	+52	26	64	+11	Swift; bright streak.
18	12 14	4	337	+83	238	+63	29	41	+38	Swift; bright streak.
22	9 19	♀*	43	+19½	50	+19¼	7	248	−18	Not swift.
24	11 56	4	235	+80	47	+10	89	230	+52	Very, very slow.
24	11 57	4	107	+50	125	+49	12	34	+19½	Swift; streak.
Oct. 11	8 32½	4	183½	+55	184	+43	12	13	+ 6	Very slow.
11	8 57½	♀	260	+20	243	+25½	16	13	+ 6 (?)	Slow.
14	9 33	4	27½	+ 1	57	− 1	29½	346	± 0	Very, very slow; D. 6 sec.
14	10 54	4	123	+70	100	+70½	7¾	133	+69	Slow; bright streak.
17	11 58½	♀	72	+11	53	+ 5½	19	90	+15	Swift; streak.
19	6 20	4	1	+34	305	+56½	43	22	+ 8	Very slow; train.
21	15 3	4	89	+13½	78½	− 2	25	132	+32	Swift; streak.
Nov. 1	8 35	4	269½	+10	268	+ 2	8	Auriga		Swift.
23	17 52½	4	132	+67	96	+84	19	141	+27	Very swift; streak.
1888 Jan. 2	10 58	4*	261	+61½	278	+64	8	250	+57	Very slow.
Aug. 2	11 19	4	346½	+ 0½	341	−11½	12	35	+54	Very swift; streak.

* Observed at other stations.

Date.	G. M. T.	Mag.	Apparent Path. From α	From δ	To α	To δ	Length.	Radiant Point. α	Radiant Point. δ	Appearance, &c.
	h m		°	°	°	°		°	°	
1888 Aug. 2	13 10	4	351½	+22	346	+14	9½	35	+54	Swift; streak.
5	11 17	4	335½	+30	325	+18	15	42	+57	Swift; streak.
8	12 3	♀	302	+56	320	+55¼	10½	291 or Lyra	+51	Very slow; bright train.
9	12 22	4	65½	+32	69½	+27	6	Perseid		Swift; streak.
13	11 33	♀*	113	+57½	126	+52½	9	43	+57	Swift; streak.
26	8 17	♀*	108½	+55	107½	+46	11	278	+52½	Swift.
30	10 30	4	222	+71	219	+68	3	225	+74	Very slow; bright train.
Sep. 6	13 9	♀	355½	+29	354½	+40	11	0	−3 (?)	Swift.
7	11 56	♀	128	+54	127½	+45	9	Polaris (?)		Streak.
7	12 23	♀	341	+40½	8	+34	22	271	+22 (?)	Very slow.
Oct. 30	9 56	4	82	+15	94	+9½	14	Taurid		Very slow.
Nov. 13	16 41	4	166	+34	172	+37¼	6	149	+22	Swift; bright streak.
13	16 55	> ♀	125½	−22	121	−30½	9⅓	149	+22	Swift; bright streak.
13	17 19	4*	252	+33⅓	257½	+31	5¼	149	+22	Swift; bright streak.
Dec. 28	9 4	4	201	+69	158	+76½	15	226	+47	Very slow; streak 5 sec.
1889 Jan. 29	11 54	4	156	+16	145	+17½	11	176	+12	Swift; not well seen.
Apr. 27	8 51	♀*	218	+49½	249	+32½	29	121	+28	Very slow; several max.
May 22†	10 8	> 1*	287	+39	254½	−15	62	63	+35	Very, very slow; D. 16 secs.(!); bright train.
July 26	11 30	4	349	+15½	320	+6	30	42	+20	Not very swift; streak.
Sep. 25†	8 5	1*	332	−7⅓	11	+8	42	269	−22	Very, very slow; D. 13 secs. (!); bright train.

* Observed also at other stations.

† These meteors are included owing to their exceptionally long duration.

Ephemeris for Physical Observations of the Moon. By A. Marth.

1890, *January* 1 *to July* 1.

Greenwich Noon.	Selenographical Colong. of the Sun.	Selenographical Lat. of the Sun.	Geocentric Libration. Sel. Long. of the Earth.	Geocentric Libration. Lat. of the Earth.	Geocentric Libration. Amount.	Geocentric Libration. Direction.
1890.	°	°	°	°	°	°
Jan. 1	32·45	−0·22	+6·06	+4·71	7·67	308·0
2	44·59	·25	5·03	3·56	6·16	305·4
3	56·72	·28	3·83	2·27	4·45	300·7
4	68·85	·31	2·51	+0·89	2·66	289·6
5	80·98	−0·34	+1·13	−0·52	1·24	265·2
6	93·11	·37	−0·28	1·90	1·92	171·6
7	105·24	·41	1·67	3·21	3·61	152·5
8	117·37	·44	3·01	4·37	5·30	145·6
9	129·50	·47	4·25	5·36	6·83	141·7
10	141·64	·50	5·36	6·11	8·12	138·9
11	153·78	·53	6·29	6·60	9·11	136·6
12	165·92	−0·55	−7·00	−6·80	9·74	134·4
13	178·07	·58	7·43	6·66	9·97	132·1
14	190·23	·60	7·54	6·19	9·74	129·6
15	202·40	·63	7·28	5·37	9·03	126·6
16	214·57	·65	6·62	4·21	7·84	122·6
17	226·75	·67	5·56	2·76	6·21	116·5
18	238·93	·70	4·11	−1·10	4·26	105·0
19	251·12	−0·72	−2·35	+0·67	2·44	74·0
20	263·31	·74	−0·37	2·40	2·43	8·8
21	275·50	·76	+1·66	4·00	4·33	337·4
22	287·70	·78	3·60	5·28	6·39	325·8
23	299·89	·80	5·27	6·18	8·12	319·7
24	312·07	·83	6·56	6·66	9·34	315·6
25	324·25	·85	7·39	6·73	9·98	312·5
26	336·43	−0·87	+7·73	+6·41	10·03	309·9
27	348·60	·90	7·60	5·77	9·53	307·4
28	0·76	·92	7·06	4·86	8·56	304·7
29	12·91	·95	6·17	3·75	7·22	301·4
30	25·06	0·97	5·03	2·50	5·62	296·4
31	37·21	1·00	3·72	+1·15	3·89	287·1
Feb. 1	49·35	1·02	2·32	−0·24	2·33	264·1

Greenwich Noon.	Selenographical Colong. of the Sun.	Lat. of the Sun.	Geocentric Libration. Sel. Long. of the Earth.	Lat. of the Earth.	Amount.	Direction.
1890.	°	°	°	°	°	°
Feb. 2	61·49	−1·05	+0·89	−1·61	1·83	208·7
3	73·63	1·07	−0·51	2·91	2·95	170·0
4	85·76	1·09	1·83	4·09	4·48	156·0
5	97·89	1·12	3·03	5·10	5·93	149·3
6	110·03	1·14	4·09	5·89	7·17	145·3
7	122·16	1·16	5·00	6·42	8·13	142·2
8	134·30	1·18	5·73	6·65	8·77	139·4
9	146·44	−1·20	−6·27	−6·57	9·07	136·5
10	158·59	1·22	6·61	6·16	9·02	133·2
11	170·75	1·23	6·71	5·42	8·62	129·1
12	182·91	1·24	6·54	4·38	7·87	123·9
13	195·08	1·26	6·05	3·07	6·79	117·0
14	207·26	1·27	5·29	−1·55	5·51	106·3
15	219·44	1·28	4·17	+0·11	4·31	75·1
16	231·63	−1·30	−2·73	+1·79	3·27	56·7
17	243·83	1·31	−1·05	3·38	3·54	17·2
18	256·03	1·32	+0·78	4·74	4·81	350·6
19	268·23	1·33	2·63	5·77	6·34	335·6
20	280·43	1·34	4·28	6·41	7·70	326·4
21	292·63	1·36	5·64	6·61	8·68	319·7
22	304·83	1·37	6·58	6·40	9·17	314·4
23	317·02	−1·38	+7·03	+5·82	9·12	309·8
24	329·21	1·39	7·00	4·96	8·57	305·5
25	341·39	1·41	6·52	3·87	7·58	300·8
26	353·57	1·42	5·67	2·63	6·25	294·9
27	5·74	1·43	4·53	+1·30	4·72	286·0
28	17·91	1·45	3·21	−0·06	3·21	269·0
Mar. 1	30·07	1·46	1·80	1·42	2·29	231·6
2	42·23	−1·47	+0·38	−2·71	2·74	187·1
3	54·38	1·48	−0·97	3·89	4·01	166·0
4	66·53	1·49	2·19	4·90	5·37	156·0
5	78·68	1·50	3·23	5·71	6·56	150·6
6	90·82	1·51	4·08	6·26	7·47	147·1
7	102·96	1·52	4·72	6·53	8·05	144·3
8	115·11	1·52	5·15	6·47	8·27	141·6

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1890.	°	°	°	°	°	°
Mar. 9	127·26	−1·52	−5·40	−6·09	8·13	138·6
10	139·42	1·53	5·47	5·38	7·67	134·7
11	151·58	1·53	5·36	4·38	6·92	129·3
12	163·74	1·53	5·09	3·12	5·96	121·6
13	175·91	1·53	4·62	1·66	4·91	109·7
14	188·09	1·53	3·95	−0·08	3·95	91·1
15	201·28	1·53	3·05	+1·53	3·42	63·3
16	212·48	−1·53	−1·94	+3·07	3·63	32·2
17	224·68	1·53	−0·63	4·43	4·47	8·1
18	236·89	1·53	+0·81	5·50	5·56	351·7
19	249·10	1·52	2·27	6·22	6·62	340·0
20	261·31	1·52	3·64	6·53	7·47	331·0
21	273·53	1·52	4·78	6·42	8·00	323·5
22	285·75	1·52	5·58	5·93	8·14	316·9
23	297·96	−1·52	+5·97	+5·12	7·86	310·7
24	310·17	1·52	5·93	4·05	7·18	304·4
25	322·38	1·52	5·48	2·80	6·15	297·2
26	334·58	1·52	4·66	1·46	4·88	287·4
27	346·78	1·52	3·56	+0·07	3·56	271·2
28	359 97	1·52	2·27	−1·29	2·59	241·5
29	12·15	1·51	+0·89	2·59	2·74	198·9
30	23·33	−1·51	−0·51	−3·76	3·79	172·3
31	35·51	1·51	1·78	4·81	5·13	159·7
Apr. 1	47·68	1·50	2·91	5·64	6·35	152·8
2	59·85	1·50	3·82	6·22	7·30	148·6
3	72·01	1·49	4·47	6·53	7·91	145·7
4	84·17	1·48	4·85	6·51	8·11	143·4
5	96·33	1·47	4·98	6·16	7·91	141·2
6	108·49	−1·46	−4·87	−5·47	7·32	138·5
7	120·66	1·45	4·56	4·47	6·39	134·5
8	132·83	1·44	4·10	3·20	5·21	128·0
9	145·00	1·42	3·52	1·73	3·92	116·2
10	157·18	1·41	2·83	−0·14	2·83	92·9
11	169·37	1·40	2·04	+1·47	2·51	54·7
12	171·56	1·38	1·15	3·00	3·21	21·0

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1890.	°	°	°	°	°	°
Apr. 13	193·76	−1·37	−0·19	+4·36	4·37	2·5
14	205·97	1·35	+0·84	5·44	5·51	351·2
15	218·19	1·34	1·90	6·20	6·48	343·0
16	230·41	1·32	2·93	6·57	7·19	336·1
17	242·63	1·31	3·84	6·55	7·59	329·7
18	254·86	1·30	4·56	6·13	7·64	323·5
19	267·09	1·28	5·01	5·38	7·35	317·1
20	279·33	−1·27	+5·14	+4·34	6·73	310·2
21	291·56	1·26	4·93	3·10	5·82	302·2
22	303·79	1·25	4·37	1·73	4·70	291·6
23	316·01	1·23	3·51	+0·31	3·53	275·1
24	328·23	1·22	2·41	−1·10	2·65	245·5
25	340·45	1·21	+1·14	2·44	2·69	205·1
26	352·66	1·19	−0·21	3·67	3·68	176·7
27	4·86	−1·18	−1·56	−4·74	4·99	161·8
28	17·06	1·16	2·81	5·61	6·28	153·4
29	29·26	1·14	3·89	6·25	7·36	148·2
30	41·45	1·12	4·73	6·61	8·12	144·6
May 1	53·63	1·10	5·27	6·66	8·49	141·8
2	65·81	1·08	5·49	6·38	8·41	139·5
3	77·99	1·06	5·38	5·76	7·88	137·1
4	90·17	−1·04	−4·97	−4·80	6·90	134·1
5	102·35	1·01	4·30	3·54	5·56	129·5
6	114·53	0·99	3·42	2·04	3·99	120·8
7	126·71	·97	2·42	−0·40	2·45	99·4
8	138·89	·94	1·33	+1·28	1·84	46·2
9	151·08	·92	−0·23	2·88	2·88	4·5
10	163·28	·89	+0·86	4·29	4·38	348·7
11	175·49	−0·87	+1·89	+5·44	5·76	340·9
12	187·70	·84	2·84	6·25	6·86	335·7
13	199·92	·82	3·66	6·67	7·61	331·4
14	212·15	·80	4·33	6·71	7·98	327·3
15	224·38	·77	4·82	6·36	7·98	323·0
16	236·62	·75	5·09	5·67	7·61	318·3
17	248·86	·73	5·10	4·69	6·93	312·7

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1890.	°	°	°	°	°	°
May 18	261·11	−0·71	+4·86	+3·48	5·97	305·6
19	273·35	·69	4·35	2·11	4·84	295·9
20	285·59	·67	3·59	+0·67	3·65	280·6
21	297·84	·65	2·60	−0·78	2·72	253·7
22	310·08	·62	1·44	2·17	2·60	213·5
23	322·32	·60	+0·15	3·45	3·46	182·5
24	334·55	·58	−1·20	4·56	4·70	166·2
25	346·77	−0·56	−2·53	−5·52	6·07	155·4
26	358 99	·53	3·77	6·22	7·27	148·9
27	11·21	·51	4·85	6·66	8·23	144·1
28	23·42	·48	5·69	6·80	8·86	140·3
29	35·62	·46	6·22	6·62	9·08	137·0
30	47·82	·43	6·40	6·11	8·84	133·8
31	60·02	·40	6·20	5·25	8·12	130·4
June 1	72·41	−0·37	−5·63	−4·07	6·94	126·0
2	84·40	·34	4·71	2·61	5·39	119·1
3	96·59	·31	3·50	−0·96	3·63	105·4
4	108·77	·28	2·09	+0·78	2·23	69·5
5	120·96	·25	−0·56	2·48	2·54	12·8
6	133·16	·22	+0·97	4·02	4·13	346·5
7	145·36	·19	2·41	5·28	5·80	335·6
8	157·56	−0·16	+3·68	+6·19	7·20	329·4
9	169·78	·13	4·72	6·70	8·19	325·0
10	182·00	·10	5·48	6·81	8·74	321·3
11	194·23	·08	5·96	6·53	8·84	317·8
12	206·46	·05	6·14	5·90	8·51	314·0
13	218·70	−0·03	6·04	4·98	7·82	309·6
14	230·94	0·00	5·68	3·81	6·84	304·0
15	243·19	+0·02	+5·07	+2·49	5·65	296·1
16	255·44	·04	4·26	+1·06	4·39	284·0
17	267·69	·07	3·26	−0·39	3·28	263·1
18	279·94	·09	2·11	1·81	2·78	229·3
19	292·19	·11	+0·85	3·14	3·25	195·1
20	304·44	·14	−0·48	4·32	4·34	173·7
21	316·69	·16	1·83	5·31	5·59	161·0

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1890.	°	°	°	°	°	°
June 22	328·93	+0·19	−3·15	−6·07	6·84	152·7
23	341·16	·21	4·39	6·58	7·90	146·5
24	353·39	·24	5·47	6·81	8·70	141·4
25	5·62	·26	6·34	6·73	9·23	136·9
26	17·84	·29	6·93	6·33	9·37	132·6
27	30·05	32	7·17	5·61	9·09	128·2
28	42·26	·35	7·03	4·56	8·37	123·1
29	54·46	+0·38	−6·47	−3·23	7·23	116·6
30	66·66	·41	5·49	−1·65	5·73	106·8
July 1	78·85	+0·44	−4·13	+0·07	4·13	89·1

Erratum in Mr. Gore's Paper on the Proper Motion of the Double Star South 503, *Monthly Notices, Vol. L. No.* 1.

Page 32, last line but one of the paper, *for* 0″·60 *read* 0″·65.